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Figure 1

Jamaica

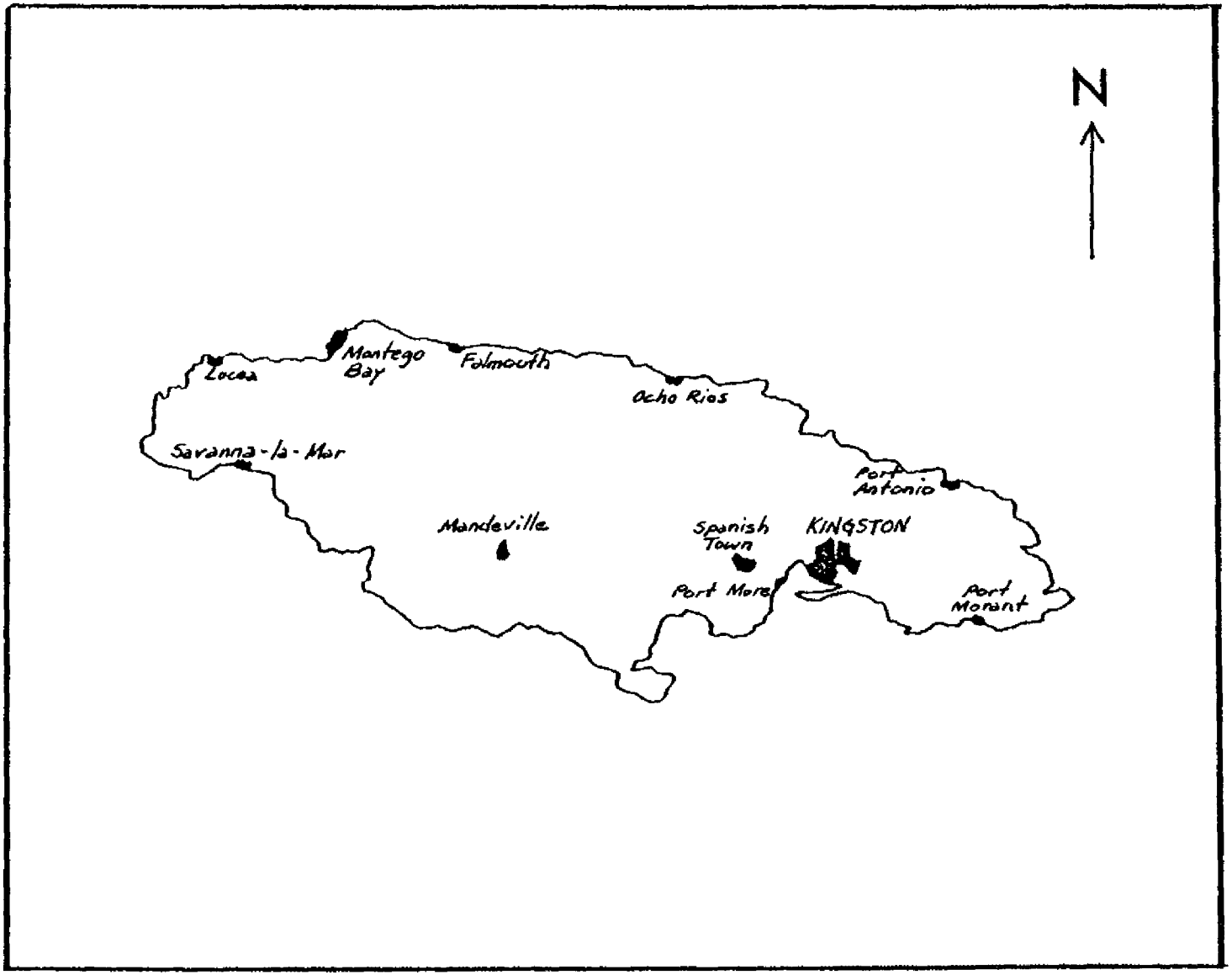

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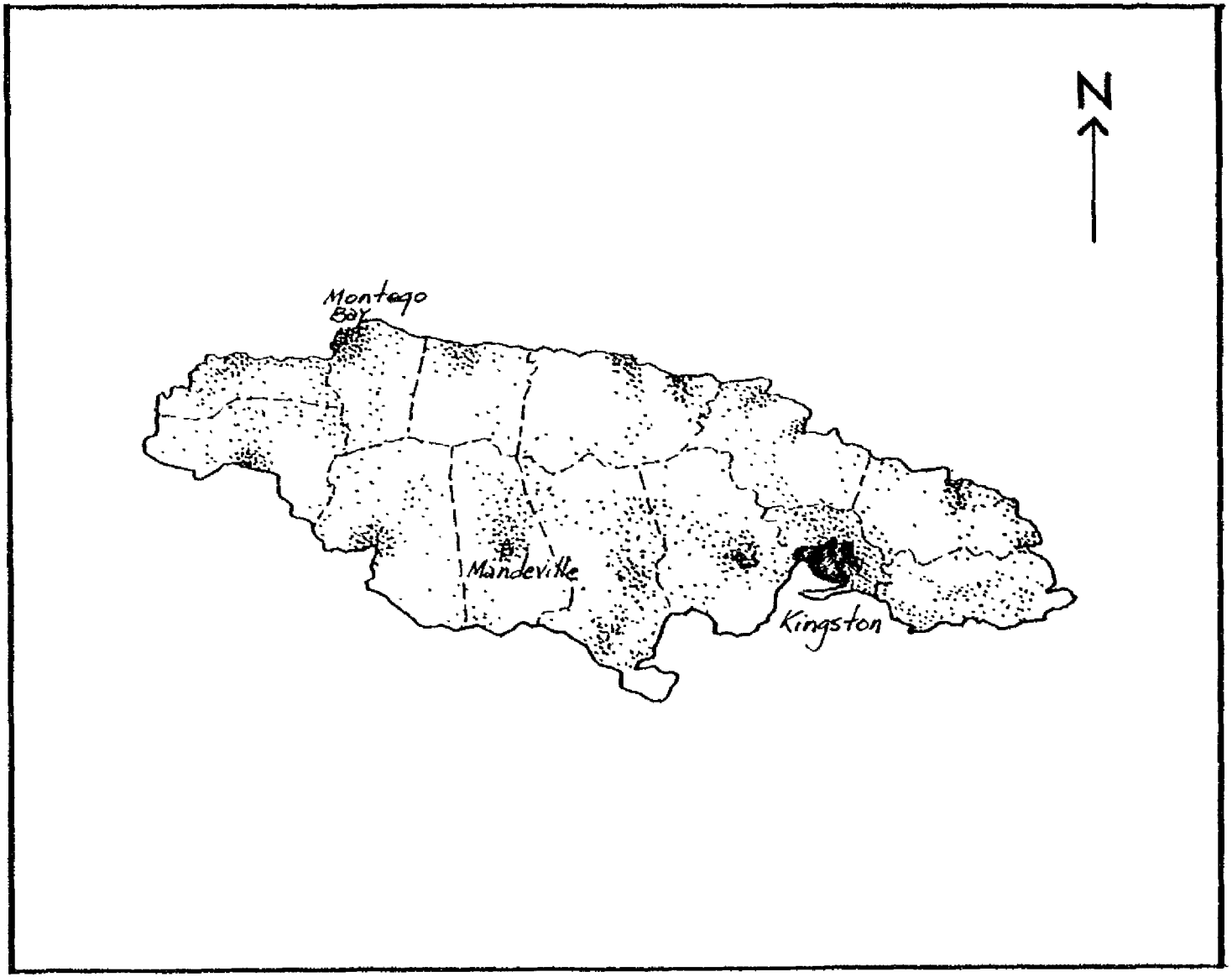
Figure 2 Population Distribution



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IMPROVEMENT OF VERNACULAR HOUSING IN JAMAICA TO WITHSTAND HURRICANES AND EARTHQUAKES

I. INTRODUCTION

BACKGROUND

In the spring of 1981, the Jamaican Office of Disaster Preparedness & Emergency Relief Coordination (ODIPERC) recognized that the majority of the 2.2 million Jamaicans reside in houses highly susceptible to hurricanes and earthquakes. Most of these buildings do not meet the standards of the existing Kingston Building Code or of the proposed National Building Code. It was further recognized that the majority of the people reside in non-engineered buildings, i.e., buildings which are constructed by the owners or by local building tradesmen without extensive architectural or engineering input and without use of disaster resistant construction techniques.

In August 1981, INTERTECT was retained by the Office of Foreign Disaster Assistance and the Office of Housing of the Agency for International Development to assist ODIPERC by conducting a survey of the vulnerability of non-engineered housing in Jamaica to the forces of hurricanes and earthquakes. The objectives of this study were:

A. To survey the vernacular housing of Jamaica and the construction techniques/methodologies used in order to:

   1. Classify the various buildings types, and

   2. Analyze the relative vulnerability of each type of building to hurricanes and earthquakes.

B. To determine design changes, improvements in the construction process, and improvements in the use of local building materials that can make housing more wind and earthquake resistant, yet remain affordable to the majority of people residing in these buildings.

C. To make recommendations for dissemination of information on safer construction for:

   1. Short-notice or emergency situations (including instructions that can be disseminated when a hurricane threatens, methods for improving safety, and techniques for reducing damage and strengthening buildings to better withstand hurricane and earthquake forces);

   2. Medium-term, self-help actions (including suggestions on how existing buildings can be improved and made safer through modification or retrofitting measures as part of normal upgrading and maintenance); and

   3. Long-term, comprehensive actions (including recommendations on how to influence the design and construction of new non-engineered houses).

D. To develop information on non-engineered construction and the vulnerability of vernacular housing which can assist ODIPERC in preparing their input into national housing policy aimed toward the protection of buildings and settlements.

KEY ISSUES

The improvement of vernacular housing to better withstand hurricanes and earthquakes should be viewed as part of a comprehensive response to the overall housing problem in Jamaica. The need and urgency for such improvement is made clear by the country's long history of hurricanes and earthquakes, in conjunction with current problems in the housing sector.

Recent reports entitled Jamaica Shelter Sector Assessment[1] and A Study of Housing in Jamaica[2] detail the existing housing shortage, point to the high number of substandard housing units, and correlate this shortage to national economic problems. The demand for housing has been estimated at approximately 10,000 new units per year.[3] The principal approaches used by the government (housing schemes, loans and guarantees) together meet only 18% of the annual demand, and the current housing deficit has been estimated to be in excess of 100,000 units.[4] If a major disaster were to occur, the sudden need for replacement housing could conceivably double or even triple the existing shortfall.

With the high level of unemployment and underemployment and the slow rate of economic growth, there is little hope of eliminating these housing problems without increased emphasis on upgrading the existing housing stock and the provision of assistance to families on an individual basis.

This upgrading can be viewed in terms of its advantages vis-a-vis disasters as well as its contribution to the resolution of existing housing problems. In terms of disasters, by emphasizing modification and upgrading, the number of units lost to a disaster will be lowered and the reconstruction burden on both the government and the people will be reduced. A house that withstands a disaster not only represents a safe refuge for its occupants, but also eliminates the tremendous discontinuity and economic burden resulting from damage to the building, and it represents a savings of both building materials and financial resources for the individual owner. For the government, it represents a lessening of the foreign exchange problem and reduction of further strains on a reconstruction economy.

Upgrading is cheaper than replacement of substandard units, and many of the measures taken to improve disaster resistance will help make the housing more livable as well as more durable. Furthermore, upgrading places the majority of the burden on the homeowner rather than on the government, thereby enabling policy-makers to spread financial resources to a greater number of beneficiaries.

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[1] Prepared by the Office of Housing, AID, 1977.

[2] Prepared for the Ministry of Public Service, Sept. 1976.

[3] Ibid.

[4] Ibid.

POLICY ISSUES

With these concerns in mind, a number of issues have arisen during the course of this study which may require policy decisions. These include:

A. The need for an agency within the government to be assigned responsibility for this sector of housing;

B. The need to rationalize building enforcement and regulation procedures to deal with upgrading of the vernacular housing stock;

C. The need for the housing sector to prepare for the rapid delivery of large numbers of new housing units in the event of a major disaster through the preparation of national reconstruction policies, streamlined delivery systems for new housing, and predetermined modes of response for the repair of damaged buildings.

DEFINITION OF TERMS

The following are brief definitions of the terms used in this report:

A. Design Changes: the process of altering the design of a structure before it is erected to make it more disaster resistant.

B. Disaster Resistant Construction: a term used to denote the degree to which a structure can be made more resistant (or safe) to certain natural phenomena. The term recognizes that no building can be considered totally safe, but that certain steps can be taken to improve performance or survivability.

C. Housing Education Program: a program offering instruction to homeowners or builders on how to build a safer or more disaster resistant house.

D. Housing Modification: changes in the configuration of an existing building to make it stronger. Modifications might include changing the pitch of the roof, adding a room, etc.

E. Housing Schemes: a term used in Jamaica to denote conventional housing projects where a large tract of land is acquired, services are installed, and a group of houses are constructed on the site.

F. Nog: a type of construction system using a wood structural frame to support masonry work used as infill.

G. Non-Engineered Buildings: those structures built either by homeowners or by local building tradesmen such as carpenters and masons without formal architectural or engineering inputs into the design or construction process. For the purposes of this report, the

term only includes those structures which could be considered formal houses; it does not include the temporary, makeshift dwellings often used by transients or families in squatter settlements prior to the construction of a more formal house. Buildings erected under housing schemes or those built according to plans or drawings prepared by housing institutions (e.g., the National Housing Trust) are also not included in this report.

H. Retrofitting: the process of installing additional supports or altering components of an existing building in order to make it more disaster resistant.

I. Risk: the relative degree of probability that a hazardous event will occur. An active fault zone, for example, would be an area of high risk.

J. Vernacular Housing: indigenous modes and styles of housing using local traditions, skills and techniques. Non-engineered buildings, as well as structures from past eras when architectural and engineering inputs were minimal, are included in the term. Vernacular housing can be identified by a particular style or design of construction, by popular features, and/or by the building methods used.

K. Vulnerability: a condition wherein human settlements or buildings are exposed to a disaster by virtue of their construction or proximity to hazardous terrain. Buildings are considered vulnerable if they cannot withstand the forces of high winds or earthquakes. Communities in unprotected, lowlying coastal areas exposed to hurricanes, or in seismic areas where a large proportion of the structures cannot withstand the forces of an earthquake, are considered "vulnerable communities".

II. RISK IN JAMAICA

HURRICANE RISK

Jamaica is situated in one of the most active hurricane regions in the world. Within the last century, thirteen hurricanes and numerous tropical storms have struck the island.[5] The casualties and damage in each hurricane underscore the vulnerability of the population and show that a majority of housing cannot withstand the forces of high winds. Almost 70% of the 380,000 people in Kingston and 90% of the 1.5 million people in rural areas live in non-engineered structures.[6] Engineering and architectural input into housing construction for moderate- and low-income families, other than that provided by the various housing schemes, is minimal.

Hurricanes threaten housing in four basic ways:

--- Damage or collapse resulting from the forces of high winds;

--- Inundation from storm surges (popularly known as tidal waves) affecting low-lying coastal areas;

--- Inundation from flooding caused by the high rainfall accompanying the storm; and

--- Damage resulting from landslides, mudslides or other displacements caused by super-saturation of the soil by heavy rainfall.

All of these threats exist in Jamaica, and few areas are without at least one of these hazards.

Figure 3 depicts the tracks of hurricanes which have struck Jamaica in the last century. Figure 4 depicts a cross-section of a typical hurricane, showing the sectors of the storm system which produce the most damage. It can be seen from this drawing that the band of destruction can be fairly wide, often spanning a diameter of up to 100 miles. Figure 5 shows those areas that are susceptible to various hurricane threats in Jamaica. Damage caused by storm surges, flooding or landslide is primarily a siting problem and thus is beyond the scope of this report.

EARTHQUAKE RISK

Jamaica is situated near the northern edge of the Caribbean Plate, close to where it abuts the North American Plate (see Figure 6). It is the relative movement along this jointure or fault that causes the earthquakes which periodically affect the country.

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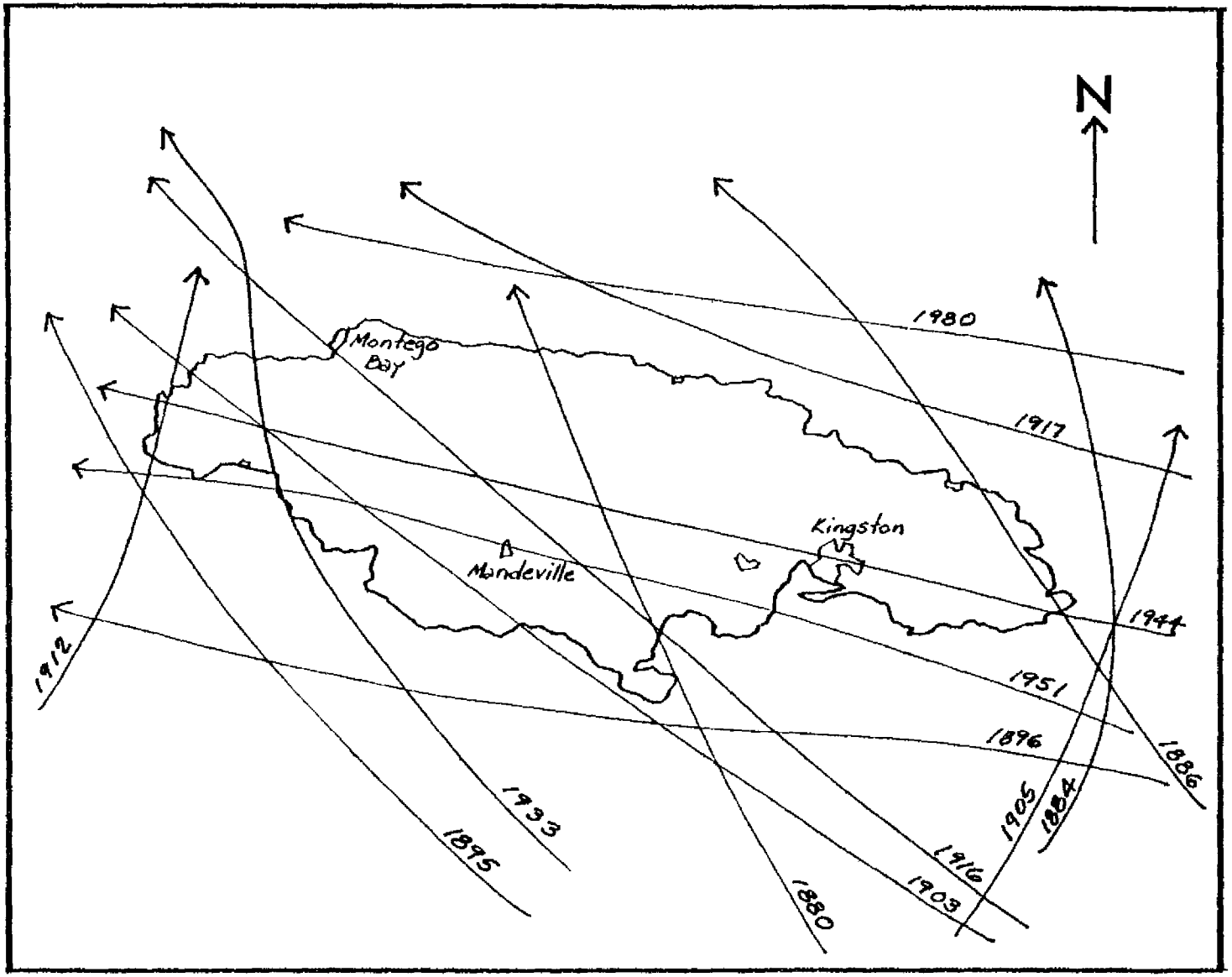
[5] Disaster Catalogue: Jamaica, prepared by ODIPERC, August 1981; and Tropical Cyclones of the North Atlantic, NOAA, 1977.

[6] Interpolation of 1970 census data.

Figure 3 Hurricane Tracks 1880-1980



Source: NOAA, 1977

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Figure 4 Cross Section of a Typical Hurricane

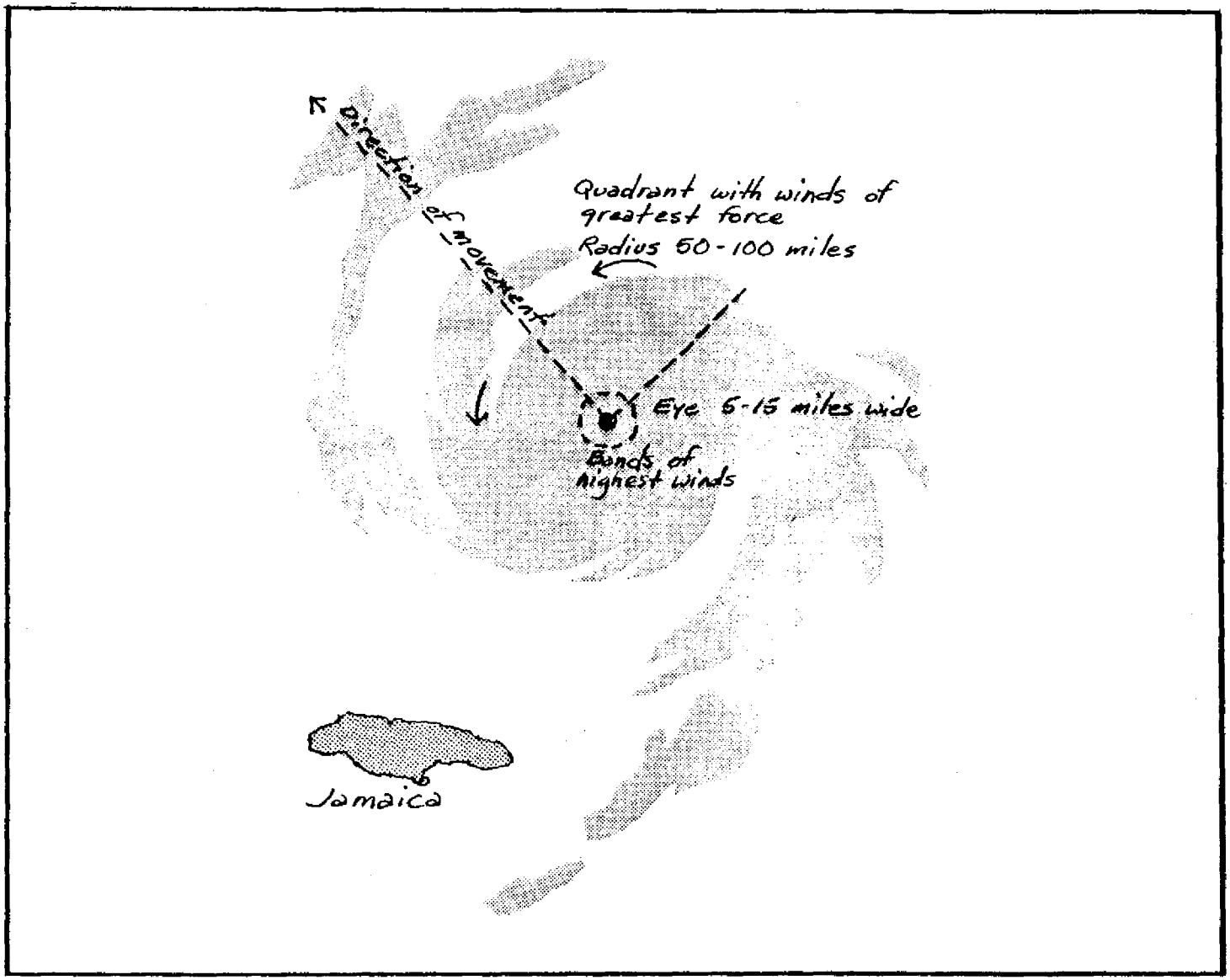
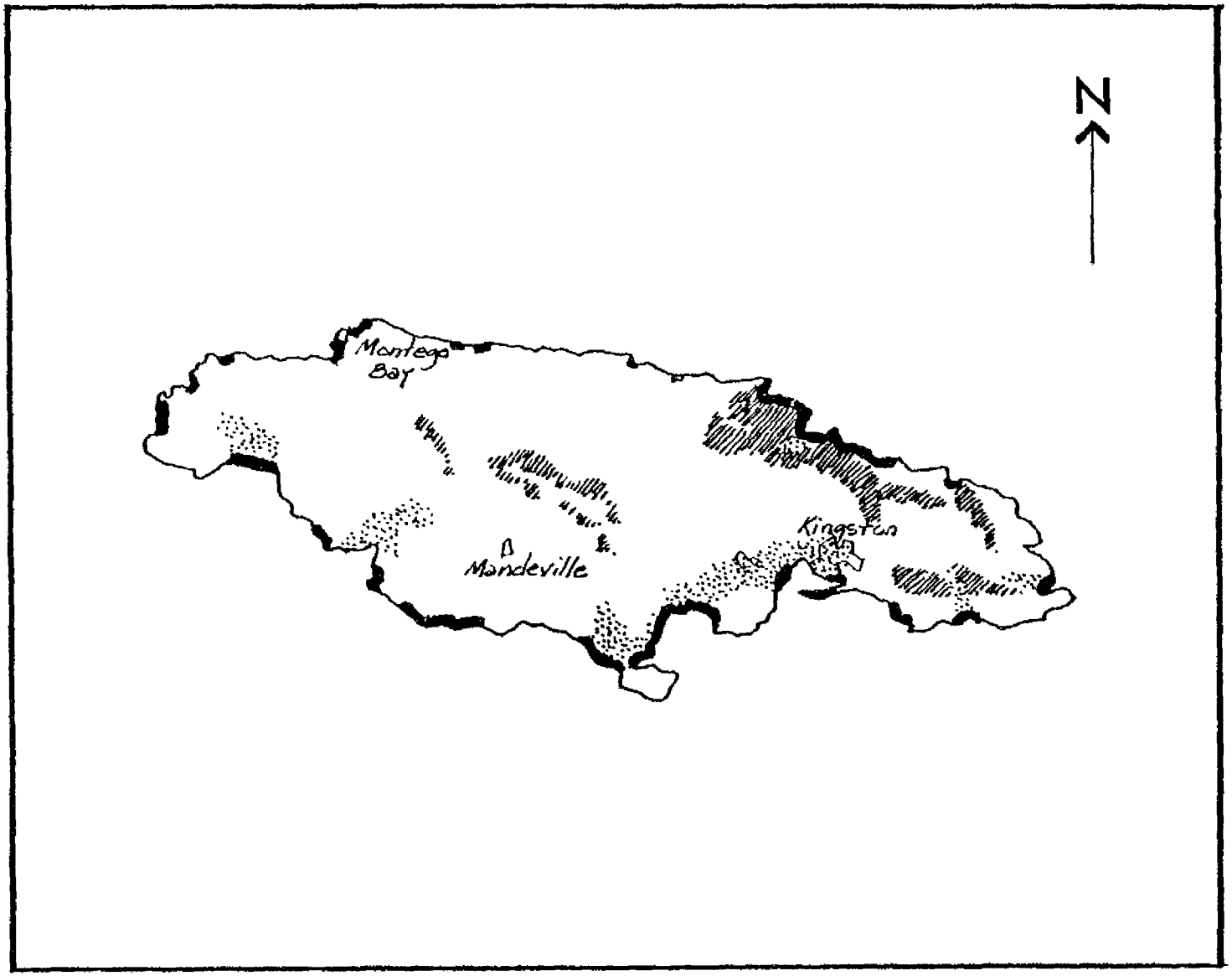


Figure 5 Hurricane Hazards in Jamaica



Storm Surge Hazard

Mudslide Hazard

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Flood Hazard

Source: ODIPERC, 1981

Earthquakes threaten housing in three basic ways:

--- Forces generated by ground-shaking;

--- Liquifaction of the soils, a condition where loosely packed soils separate and behave similarly to water when shaken by an earthquake, thus allowing buildings on the surface to partially sink or settle, damaging them in the process; and

--- Secondary effects, such as landslides or tsunamis (seismically-generated sea waves).

Damage from liquifaction and secondary effects is of major concern in Jamaica due to the types of soil. Major damages from liquifaction occurred in the great Port Royal earthquake of 1692, and the extensive damage to port facilities in Kingston in 1907 are attributed to this phenomenon.

By locating the major fault systems and examining the history of earthquakes throughout the country, it is possible to identify the relative potential for recurrence of seismic activity. This information is presented in Figure 7. However, this chart only shows recently recorded data and should only be considered as an indication of where current activity is being felt. It is important to remember that an event could occur at any time in an area not now active (e.g. the 1957 earthquake near Montego Bay, a previously inactive area) and that Jamaica is relatively small, thus a very large magnitude earthquake in the more active eastern zone could possibly be felt throughout the island.

ESTABLISHING PRIORITY AREAS FOR VULNERABILITY REDUCTION

As a general rule, comprehensive vulnerability reduction efforts should be initiated in areas where there are certain indicators that such efforts will succeed. Among the indicators are areas where new construction is occurring (such as the growth areas around cities and towns), areas where agricultural activities are strong and where migration from rural to urban areas is minimal, and areas where a threat from a disaster is perceived as being a major problem to the majority of homeowners within the region. Thus, by examining demographic trends and density, and areas of economic growth, priority areas for establishing vulnerability reduction efforts can be identified. These are shown in Figure 8.

Figure 6 Tectonics of the Caribbean Basin

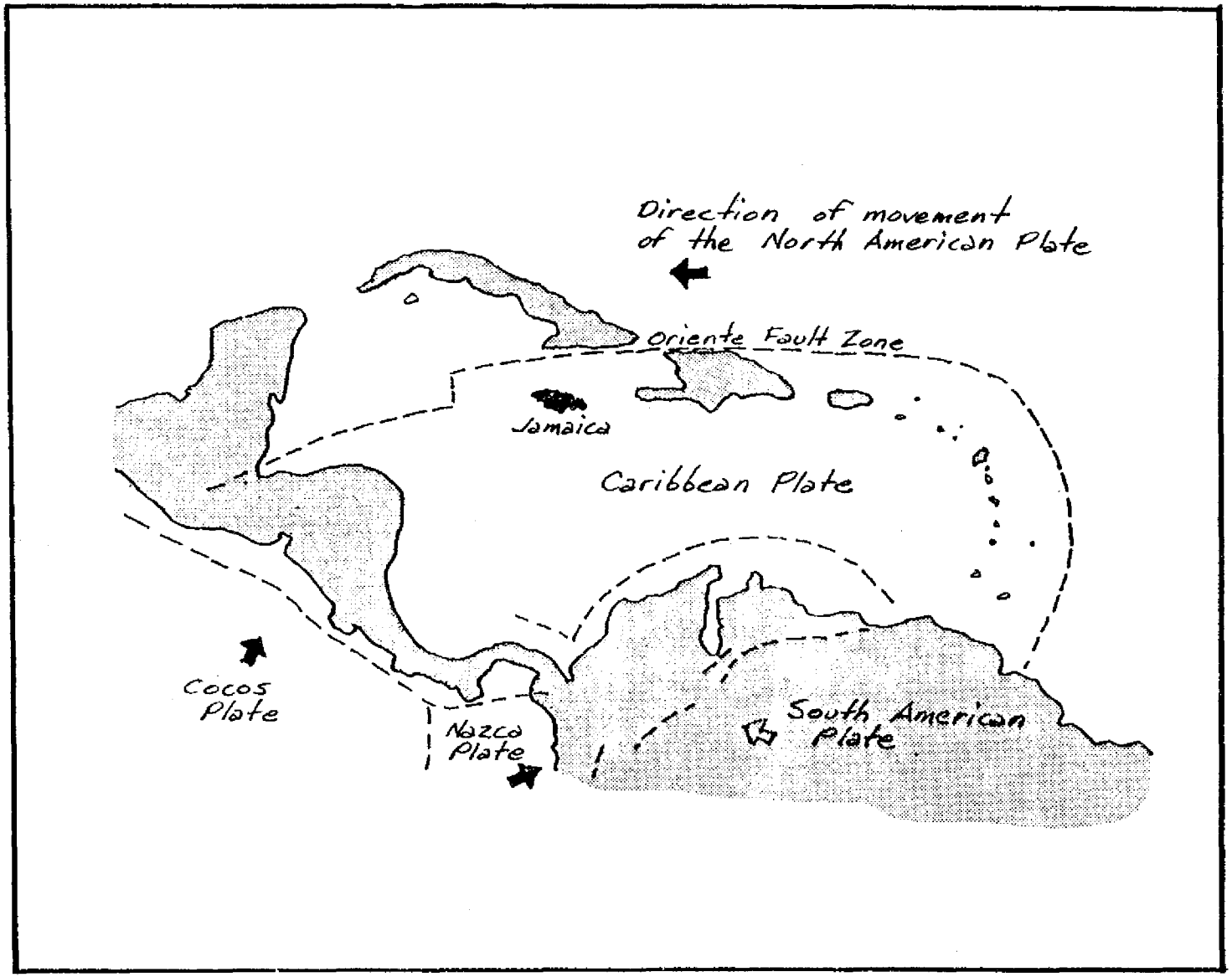

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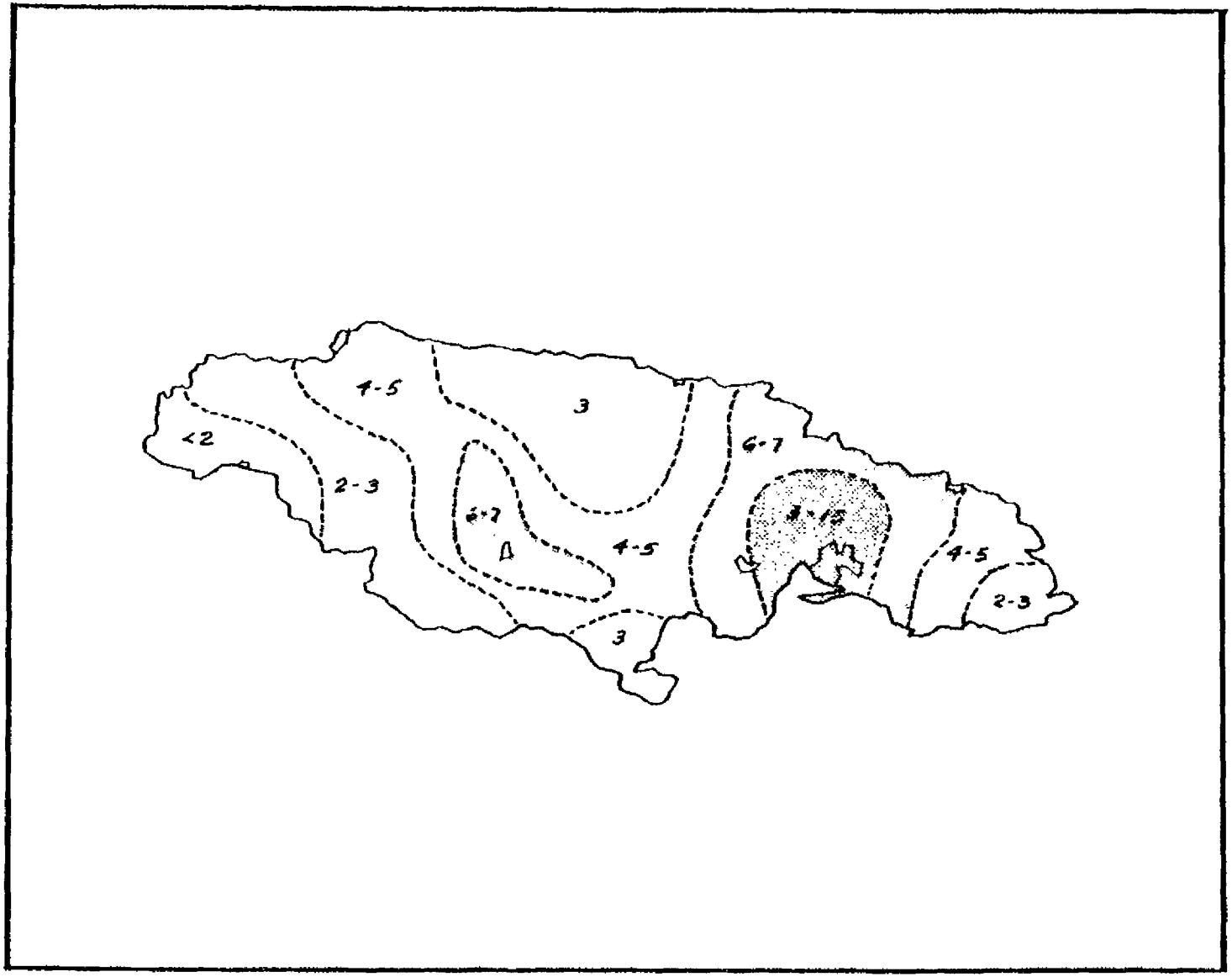
Figure 7 Seismic Activity in Jamaica



Numbers indicate average number of Earthquakes per century over Intensity VI.

Source: Pereira, 1981

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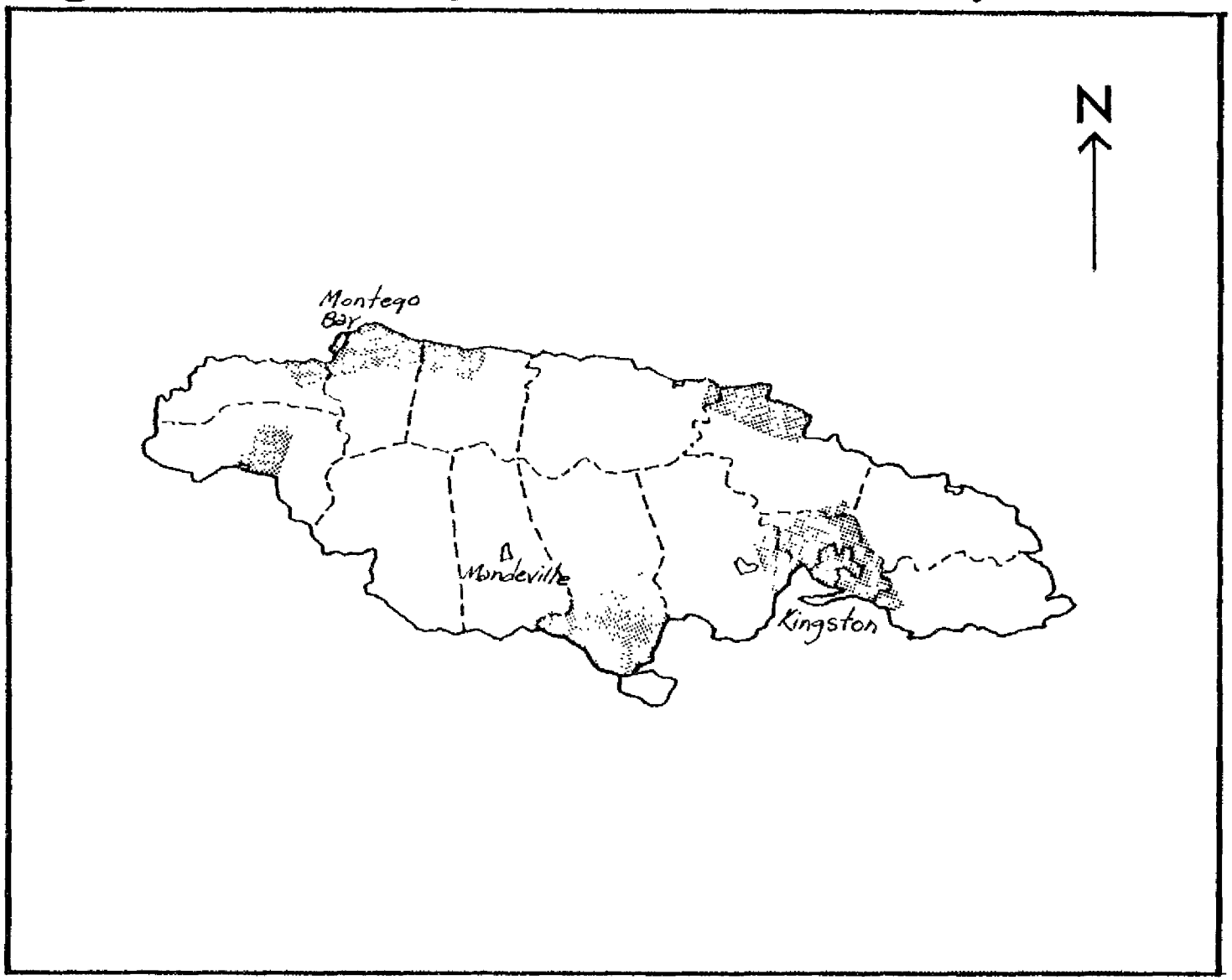
Figure 8 Priority Areas for Vulnerability Reduction



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III. HISTORY OF VERNACULAR HOUSING IN JAMAICA

EVOLUTION OF VERNACULAR HOUSING

Jamaica contains a wealth of architectural history, charm and distinction. While the Great Houses of the Georgian and Victorian periods are the primary buildings of historic and architectural significance, the country retains a simple yet dignified vernacular style. While most of it is humble and unpretentious, the buildings represent a unique form of building expression and provide a significant link to various eras in the history of the country.

Many of the building forms and features still found today in traditional and vernacular architecture date back to specific periods in the history of Jamaica when building construction activities were influenced by other events. The most significant historical periods in the evolution of vernacular housing were the Falmouth and North Coast sugar boom, the Crown Rule period, the rise of Kingston, and the late Colonial period.

A. The Falmouth Period (1790-1820): No other era had as much influence on vernacular housing as did the rise to prominence of Falmouth and the other north coast towns during the period of the great sugar boom. The architecture of the period is distinctly Georgian and is a unique style still found today. In recalling the period, most people remember the Great Houses of the sugar plantations. While these were indeed important, there were also smaller buildings, especially merchants' houses in the cities and public buildings, which also helped to establish the architecture of the period.

   It was during this period that most of the building techniques found in vernacular housing today were introduced. The techniques of stone masonry, wood frame construction, wattle-and-daub, Spanish wall, and nog construction were all utilized during this era and adapted from their English origins to the Jamaican climate and environmental demands.

   That the building styles and methods were distinctly English cannot be doubted. What little influence remained from the Spanish period was eliminated at this time; and even wattle-and-daub construction, which many historians have linked to African origins, clearly shows many of the techniques used in Wales and other parts of the United Kingdom during this same period.

   There were no architects and few engineers in Jamaica at this time, so patterns and designs were obtained from England and modified for the conditions in Jamaica. Thus, while many of the buildings owe much in form, style and design to the Georgian period, they remain distinctly Jamaican. Many of the adaptations were to make the houses more resistant to high winds and hurricanes. Especially notable were the practices of using hipped roofs, sashed windows, storm shutters, and only minimal eaves along the roof edges. These features were so successful in protecting the buildings against hurricane damage that they have remained popular even to the present day, although many people do not recall their origins.

B. The Period of Crown Rule: From the 1830's to the 1860's, Jamaica underwent a period of major reorganization. With the decline of the plantations, the collapse of the sugar market and the emancipation of slaves, the society that had existed at the height of the Georgian period disintegrated and was forced to change dramatically. This period, often referred to as the "dark age of Jamaican history", saw a decline in construction of larger, more formal buildings and a proliferation of construction of marginal and poor quality buildings by the newly emancipated blacks. Most of the buildings were wattle-and-daub or timber frame and continued to follow construction techniques that had been developed during the Georgian period, although construction was of poor quality and few of these buildings survive today.

With the imposition of Crown Rule in 1865 after the Morant Bay Rebellion, a new period of prosperity began. Bananas were introduced, enabling small, marginal farmers to find enough profit to construct more formal houses. As the economy expanded and more people were able to accumulate excess capital, a new wave of construction occurred. Many of those building for the first time desired more permanent houses than those of wattle-and-daub or wood frame; yet stone construction or brick (which had been introduced at mid-century) was too expensive. Nog construction, a cheap form of building with stone, was ideal, and many of the homes of this period were built using this method. Wattle-and-daub and Spanish wall construction were still used by the poor, and wood frame buildings retained some degree of popularity in all economic groups.

The new buildings retained many of the features which had been developed during the Georgian period, although they were scaled down considerably in size because of the rising cost of building materials. Distinctive designs of the period were the "L" and "U" shaped floor plans; and bay windows and "gingerbread" decorations on the front of the house were popular features. Builders continued to use storm roofs (although the term "storm roof" faded from popular usage) and gabled roofs became more popular.

C. The Rise of Kingston (1872-1914): In 1872, the capital was permanently transferred from Spanish Town to Kingston. This new capital flourished and architecturally it became the trendsetter for the rest of the country, also developing its own unique style and type of construction.

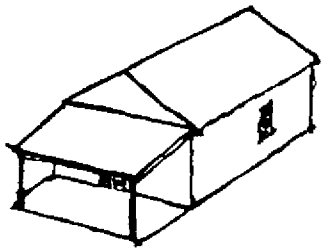
At the end of the 19th century, brick factories had been set up and Kingstonians rapidly developed a liking for this material. By 1907, nearly half of the buildings in Kingston were made of brick and many two- and three-story structures, especially along the waterfront, had been erected.

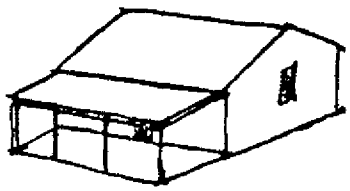
Catastrophe followed. On the afternoon of January 14, 1907, a massive earthquake shook Kingston. The brick houses toppled and fell, killing almost a thousand persons. The era of unreinforced brick masonry was over; in its place, builders developed an adaptation of nog construction. Brick nog used a wood frame to

reinforce the wall and wire crossbraces to reinforce the frame (see Chapter IV). For the next thirty years, this was the most prevalent form of construction for moderate and middle-income housing in Kingston and other major cities, and today these houses still make up much of the housing stock in Old Kingston and West Kingston.

Many popular features which are still used in larger houses became popular during this period. Of special interest is the veranda. The word "veranda" is derived from the Indian word meaning protection or shelter from the sun or rain. During the Georgian period, small verandas were often placed on the second story of larger buildings in the towns to provide cover for sidewalks as well as a porch for the upper floor. In Kingston, one-story houses with verandas became very popular. Usually the roof was extended and supported by columns, and a large open area was created as a "social area" on the front of the house. So popular were verandas that almost no formal house today is without one.

The screened and open veranda subsequently adopted was relatively well-suited to the hurricane environment. Instead of extending the roof out over the veranda, a small, relatively flat-pitched roof was attached to the house (see below). This type of roof was designed because only short lengths of timber were available, but the design proved useful since the main roof of the house would remain intact if the veranda roof was blown off by high winds.[7]





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[7] "Vernacular Housing: A Stylistic Base?", Neil O. Richards, Jamaica Architect, Issue 8.

At the turn of the century, a new building material was introduced that was to have a profound influence on housing. Cement was introduced for the construction of several government projects and quickly found acceptance as an ideal material for making mortar. In 1902, a small cement plant was established. After the 1907 earthquake, the use of cement in masonry construction was encouraged and, by the 1930's, cement block construction was becoming popular. In the following years, this was to become the most popular type of building material for all types of construction.

During the first quarter of the 20th century, concrete nog was developed. Basically, a house was erected with a timber frame and infilled with panels of concrete. Internal partitions and floors were made of wood, the latter being constructed at about two feet above ground level and supported on concrete piers.

D. The Late Colonial Period (1945-1964): The period between World War I and World War II was marked by a growing economic stagnation and an increase in many of the social and economic hardships on the people of Jamaica. Concerned by labor disturbances in the West Indies, a Royal Commission was sent to inquire into the status of the islands. However, before the report was published, world war became a reality.

The war had the effect of drawing attention to the West Indies, partly as a result of growing criticism of Britain's treatment of her colonies, and partly because of concern over the poor conditions brought to light by the Royal Commission. Great Britain realized that, if it were to expect support from the colonies for the war effort, concessions would have to be made for the economic betterment of the colonies.

In 1940, a summary of the Commission's recommendations was published and the first Colonial Development & Welfare Act was passed which guaranteed funds for economic development in the West Indies. The first act was little more than a promise of better treatment in the future; but immediately after the war, a second act was passed, increasing dramatically the amount of money available for development. A Colonial Development Corporation and an Anglo-American Caribbean Commission (later reorganized as the Caribbean Commission) were established. These were to play an important part in providing a framework for the long-needed social and economic development of the area as a whole.[8]

In terms of housing, the importance of these developments was due to the acceptance by the Colonial government of responsibility for the provision of housing for certain groups of low-income families. Prior to this, the only official intervention in housing was in Kingston via the building code.

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[8] History of Jamaica, Clinton V. Black, Collins Press, London, U.K., 1965.

Early housing efforts by the government concentrated on providing housing for indigents and for seasonal agricultural workers on the sugar estates. With the help of architects from the Colonial Office, schemes were developed to acquire land and erect housing for workers. This approach has become the standard method through which the government provides housing.

In 1951 Jamaica was struck by Hurricane Charlie which caused extensive damage on the south coast, especially in Kingston. In order to help low- and moderate-income families rebuild, a Hurricane Housing Organization (HHO) was formed. Wooden houses, designed as interim structures (although many remain in use today) were provided throughout the disaster-affected area. Reconstruction loans and grants were also provided by the Organization. As the extent of the damage, as well as the general poor state of housing throughout the island, became known, the HHO was reorganized and eventually became the Housing Ministry. In regions outside of the hurricane-affected areas, new emphasis was given to building houses meeting the newly recognized housing demand. Land was acquired or provided by the government and housing schemes were conducted throughout the island.

Two important contributions to vernacular housing were made during this period. First, because cement could be manufactured in Jamaica at a relatively low cost, cement block construction was adopted by the colonial government as the primary method of constructing low-income housing. With heavy government emphasis on block, and by purchasing large quantities of blocks for its own projects, the overall cost of this material remained low and affordable to low and moderate-income families, especially those in the towns and cities. Thus, more and more people began to build with block.

Second, with the growing popularity of block, the government recognized the need for adopting suitable construction standards that would ensure safety. In 1953 a standard configuration and uniform sizes for residential blocks were adopted, along with requirements for reinforcement. Government-financed block construction followed these standards and, through widespread use, almost every block building made today (including most low-cost housing) continues to follow these norms. Thus, the basic features of contemporary block and steel housing evolved during this period.

By the end of the period, wattle-and-daub, Spanish wall and even stone nog buildings were on the wane. Brick nog construction, so popular in the aftermath of the Kingston earthquake, died out altogether by 1950. Wood frame houses were still built, although in many areas they became smaller and were used more for transient housing or interim buildings.

The designs and features of the buildings continued to reflect the style of those structures erected in previous building eras, but many ornamental facades and detailings disappeared from new construction. New designs and features introduced during this period were

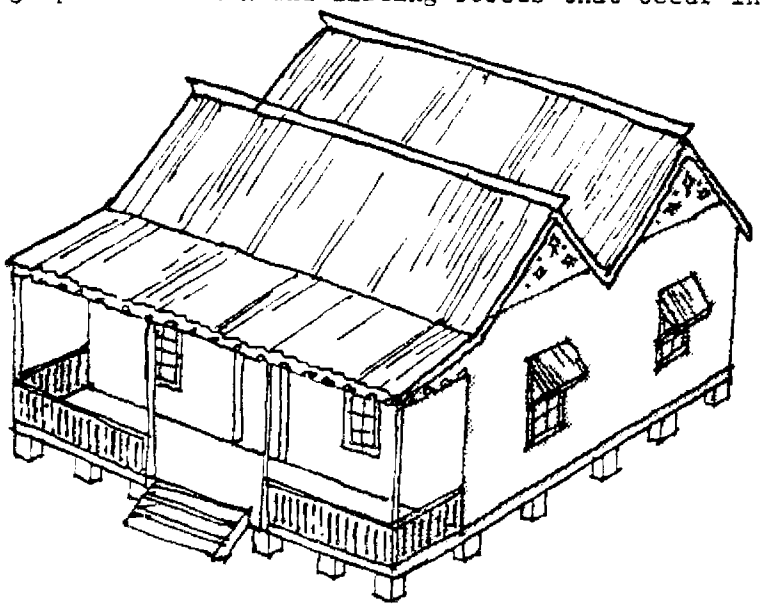
flat sloping roofs for block houses and louvered windows which soon became standard for almost all new construction.

HURRICANE AND EARTHQUAKE ARCHITECTURE

The principles of disaster resistant construction today were not thoroughly understood by the early builders in Jamaica. However, through trial-and-error and common sense, many techniques and features were developed to reduce damage from the storms and earthquakes that struck periodically.

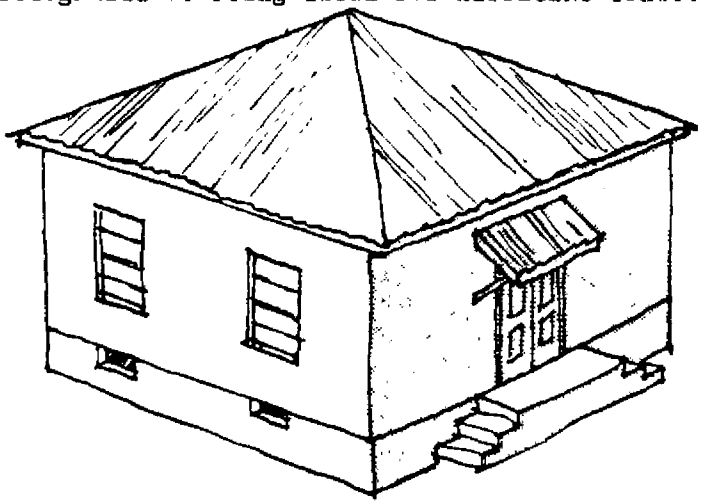
Early settlers realized that hurricanes were the most prevalent threat. They also found that the Georgian patterns and designs sent from England were susceptible to high winds. Thus, a number of features were incorporated into these designs to improve the resistance of their homes. Among the features that were adopted and that are still used today are:

A. Double (Storm) Roofs: The use of storm roofs (i.e., a single roof over each major room or portion of the house) was an early adaptation to hurricanes. It offered two advantages. By using shorter timbers, the strength of the roof frame was increased. And if the roof was blown off one part of the building, other rooms were still protected by their own roofs. Although unknown at the time, the wind flow characteristics of a double roof are ideal for breaking up the suction and lifting forces that occur in high winds.

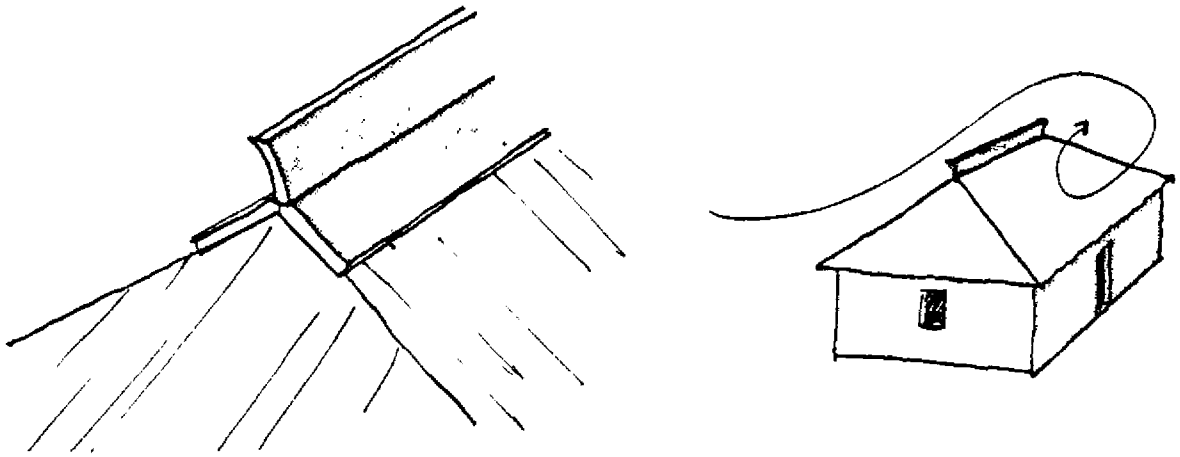


B. Hipped Roof: Early builders recognized that a hipped, rather than gabled, roof configuration offered the best adaptation for survivability in high winds and for interior comfort. The hipped roof configuration was not only used as a single roof, but also in the double (storm) roof design. The configuration is strong due to its shape. Without understanding the physics involved, it is surprising that the early builders utilized the high roof pitches that were common. This may have been a concession to the climate; but for

whatever reason, the high pitches (30°-35°) often found on these roofs are now recognized as being ideal for hurricane conditions.



C. Roof Combs (Crown Pieces): An ornamental comb or crown was often placed on the ridge of the roofline. The purpose was usually to cap the roof so that it would not leak. However, these combs serve as "spoilers", creating turbulence at the peak and thereby helping to break up the suction and lifting forces on the roof.



D. Minimal Eaves: Early builders recognized that large overhanging roofs or eaves would be subjected to uplifting forces from winds deflected up from the walls. Thus most of the houses were built with only a minimal roof overhang.

E. Hurricane Straps: The practice of fastening the roof frame securely to the building was first seen in Jamaica in the mid-1700's.

F. Building Configuration: Early builders recognized fairly quickly that the strongest practical shape to resist hurricane winds was a relatively square building. In early construction, most small buildings were square, and even the larger ones tended to be not overly long and narrow.

G. Sashed Windows: Sashed windows (designed to slide vertically in the window frame) were a popular feature in Georgian architecture, and their advantages as a means of relieving pressure inside a house during a hurricane were quickly realized.

H. Storm Shutters: The use of storm shutters to help protect those inside a house from flying debris was one of the first adaptations to hurricanes found in vernacular architecture.

Unlike hurricanes, earthquakes were infrequent; thus the ability to adapt architecture on the basis of trial-and-error and visual observation of the effects of an earthquake was not possible. There were no records concerning damages, types of buildings reconstructed, or modifications made as a result of the Port Royal earthquake in 1692. So, prior to 1907, builders in Jamaica knew very little about how to strengthen a house to improve its performance in an earthquake. The major concern was still hurricanes and high wind storms and, while tremors had been felt throughout the island, the only adaptation was to build structures whose upper portions were lighter than the lower portions.

Several changes were introduced as a result of the 1907 Kingston earthquake. Nog construction demonstrated its survivability and it was quickly realized that the framing system of nog offered many advantages. The few buildings that used cement mortar also exhibited a higher degree of survivability than those with lime or other traditional mortars; thus cement mortar became popular. Other techniques (such as internal reinforcement, balance, use of ring beams, etc.) were not recognized until very recently.

CONTEMPORARY NON-ENGINEERED HOUSING

Contemporary non-engineered housing can be divided into three classifications: rural, urban yard, and urban single-family housing. While the housing types and construction methods used are similar, there are distinct characteristics that are important to note.

A. Rural Housing. Important characteristics of rural housing include:

1. The majority of people still using traditional construction methods, as well as the majority of older traditional buildings, are found in rural areas.

2. The majority of rural housing is single-family.

3. The size of new rural houses is usually very small. This is due in part to lack of resources, the cost of land, and uncertainty concerning land tenure.

4. In rural areas, the owner-contractor relationship is still strong. The skills of the contractors, however, are not as good as those of urban contractors.

5. Wood is still the primary structural component used in new housing. Nog and wood frame houses still account for a substantial amount of new construction in rural areas, although these methods are rapidly being replaced by reinforced concrete block construction (known locally as "block and steel").

6. The most prevalent styles now found are those developed during the Crown Rule period. Newer construction, especially that

of the last 10 years, is along lines established during the late Colonial period.

7. The most popular roofing material in the rural areas is zinc sheeting.

B. Urban Housing. The principal characteristics of urban construction are:

1. Almost all new construction is of block and steel.

2. The majority of non-engineered buildings are occupied by more than one family. (Tenement yards are discussed later.)

3. Houses in the urban areas tend to be slightly larger than their rural counterparts, especially the older buildings.

4. The majority of people residing in non-engineered housing are renters. Repairs, maintenance and upgrading will therefore be more difficult.

5. The most prevalent style of older buildings is that of the post-earthquake Kingston period. The majority of buildings in the older parts of the city are made of brick nog. The newer houses have no distinct style and are expanded and adapted to whatever land is available.

6. Almost all new construction in urban areas is on the periphery of the cities. Few new houses are erected in the older sections (although additions are made to older buildings).

In Kingston, many of the urban poor live in two distinct patterns of settlement: urban tenement "yards" and squatter settlements.

C. Yards. Tenement yards date back to the 18th century when landlords rented small rooms to transient slaves sent to work in the city. After emancipation, the practice of renting to transients continued, but families rather than individuals moved into the yards. Today these yards make up a large portion of the slum housing available to new arrivals as well as to the very poorest families in the urban sector.

The older tenement areas are usually located in the central city. The areas are physically deteriorated, overcrowded, and lacking in community facilities, although water and electricity are usually available. The areas are characterized by a large number of families living in an enclosed yard in close proximity and sharing basic services such as a standpipe, kitchen, and toilet facilities. Almost all of the occupants of yards are renters.[9]

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[9] Jamaica Shelter Sector Assessment, Office of Housing, AID, 1977, p. 36.

There are two types of tenement yards: tenant yards which are owned by individual (usually absentee) landlords, and government yards where the government is the landlord. A study of yards in 1970 indicated the following characteristics:[10]

1. Design: The size of the lot may range from one acre to a narrow strip of land. The number of households and separate dwellings generally ranges from eight to thirteen. A household often occupies only one room.

   The siting of the rooms in the tenant yard depends on the presence or absence of the landlord. If he resides on the site, he usually occupies the front house and tenants live in the lanes (footpaths) behind his house, with their entrance to the yard via a side gate. In the yard, there are several clusters of tenant buildings separated by zinc fences. This cluster of houses between zinc fences represents a yard. In some cases, there may be several yards behind a landlord's house. (See illustration on following page.)

   Government yards, on the other hand, typically consist of one or two long buildings subdivided into rooms with each family occupying one unit. It is interesting to note that many government yards originated as a result of a desire to provide temporary housing in the aftermath of a catastrophe such as a flood or hurricane. (See illustration on following page.)

2. Sociological Characteristics: Tenement yards exhibit certain unique sociological characteristics that are important to note, including:

   a. High Mobility Among Residents. Surveys have shown that persons living in tenements constantly move from one yard to another. Few live in any yard longer than five years (the average number of years is slightly higher in government yards).

   b. High Degree of Social Interaction Among Residents. It has been observed that the level of interaction in a tenement yard is very high, with people sharing many activities and participating in social activities. Observers have indicated that the yard serves an important function in helping to socialize migrating Jamaicans into the Kingston and wage-earning culture.

      Because of the high density, the yard demands a higher degree of communal life than any other form of living in Jamaica. Dwellers depend upon each

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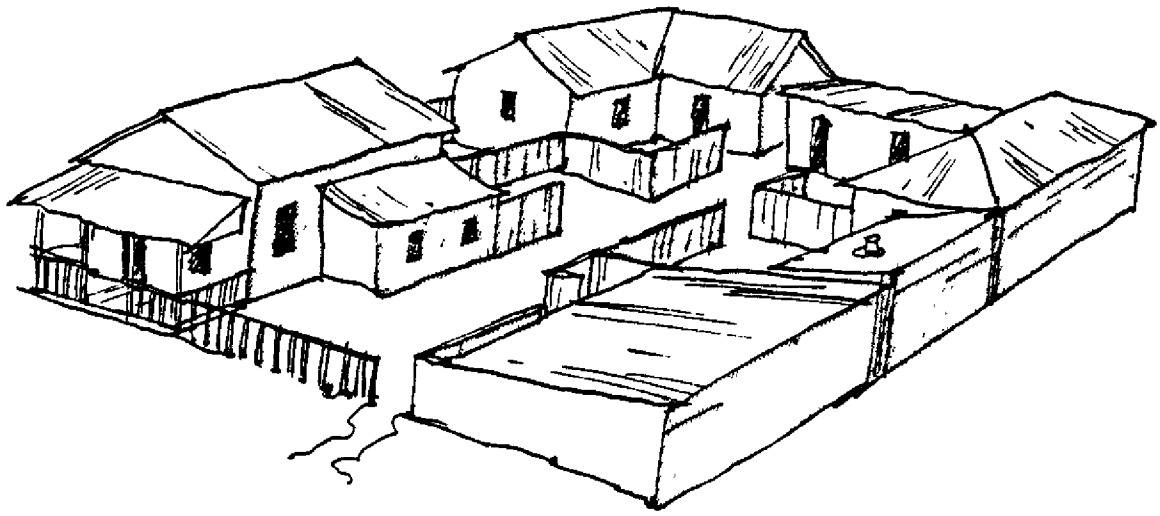
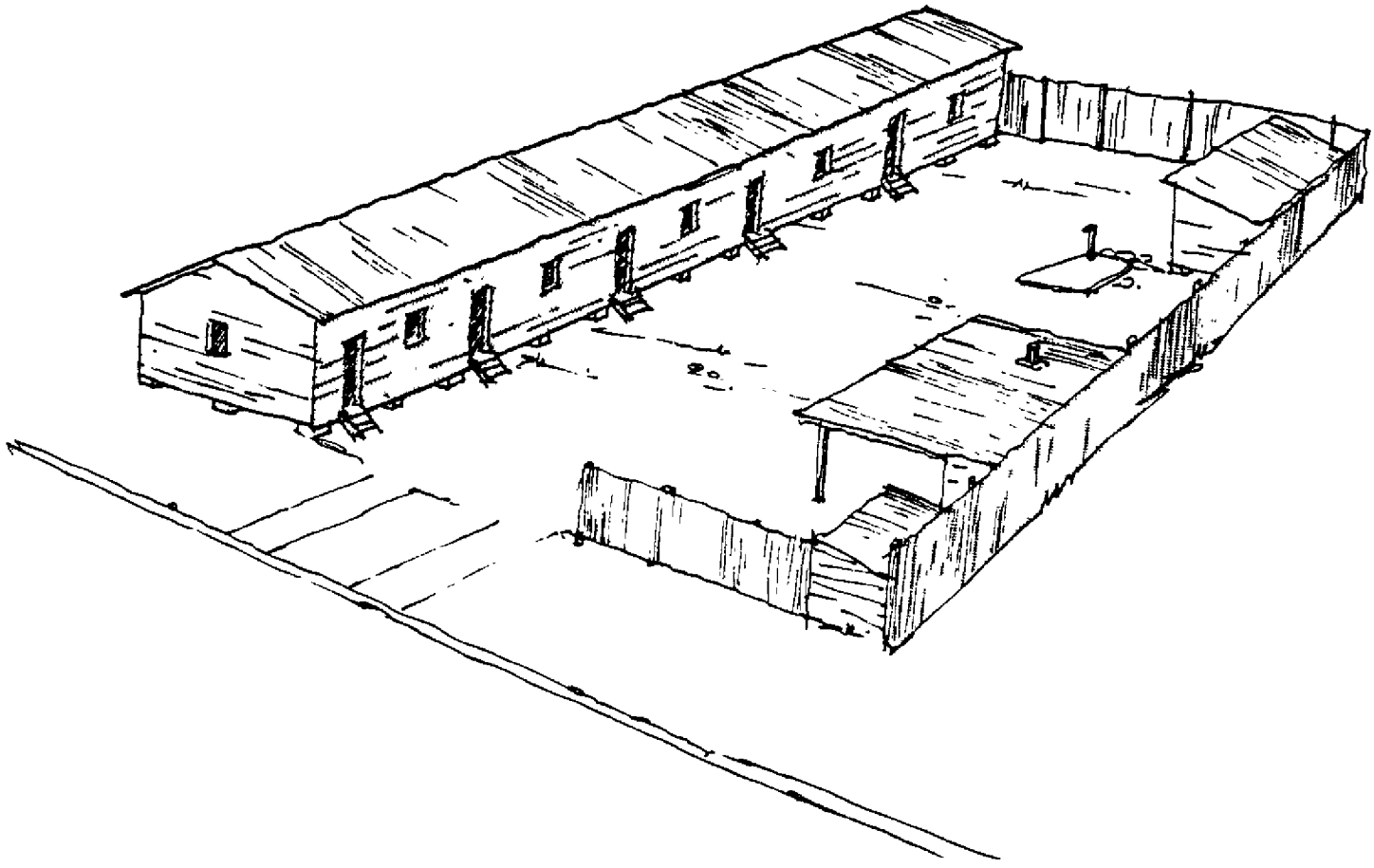
10 A Study of Yards in the City of Kingston, Erna Brodber, Working Paper No. 9, Institute of Social and Economic Research, University of the West Indies, Mona, Jamaica, 1970.

TENANT YARD



GOVERNMENT YARD



other for material and emotional assistance, and a high degree of social interaction is thus an inevitable feature of the yard.[11]

c. Female Orientation. A unique aspect of yard society is that the majority of persons responsible for paying the rent are female. Even though men often live permanently in the household, they normally have established a live-in relationship with the women who (even though they may bear the men's children and live in a husband-wife relationship) are still considered the heads of the households.

3. Vulnerability of the Yards: The majority of structures in yards are poorly built. The materials utilized are usually salvaged or available at little or no cost from construction sites, and only in a few cases are the buildings more than semi-permanent. There are no standard features of yard buildings. While some degree of protection from high winds may be afforded by the close proximity of the buildings, the flimsiness of construction will precipitate widespread losses in a hurricane. In an earthquake, even yard buildings made of block are likely to experience a high percentage of failure because little reinforcement has been used in their construction. The lightweight ramshackle yard buildings made of wood or zinc sheets, however, are unlikely to cause major injuries in a tremor.

Upgrading of the yards will be extremely difficult due to the social and economic characteristics of the people and the high density in each yard. A major obstacle in many yards is that absentee landlords won't make improvements because the tenants won't pay rents and the tenants won't pay rents because the houses are not maintained.

There does appear to be adequate land for redevelopment within the urban centers and, through a careful program of upgrading and redevelopment in urban areas, the vulnerability of people currently living in yards could be substantially reduced.

D. Squatter Settlements. The squatter settlements of Jamaica also have distinct characteristics. Squatters normally occupy (or capture) land and build a house to secure the site. They often locate on government land near gullies, in railroad rights-of-way, or on public lands. They also invade private land if it is perceived that owners may not react.[12]

Squatters usually build one-room shelters of wood and erect a fence around their yards. The first squatters in an area capture as much land as they are able and then rent portions to other squatters. Density increases as the land is divided into smaller plots for rental purposes. Additions and improvements to dwellings occur as tenure becomes more secure.[13]

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11 Ibid.
12 Jamaica Shelter Sector Assessment, Office of Housing, AID, 1977, p. 44.
13 Ibid.

Squatter settlements are found surrounding all the major cities in Jamaica. The people who move to the squatter areas normally come from rural areas but, in the cases of Kingston and Montego Bay, some of the squatters are inner-city residents who have moved to outlying areas in pursuit of land and their own single-family home.

Studies of squatter settlements conducted in conjunction with squatter upgrading projects by the Ministry of Housing show that:

1. Squatter settlements are more male-oriented, with the head-of-household being identified as male in more than half of the cases.

2. Squatter settlements are less dense than yards. Structures usually have only one family per house and only one house per site.

3. There is less mobility among the population of squatter settlements than in the yards. People occupying the land will continue to do so as long as tenure is permitted.

4. Facilities and infrastructure are not communal (except for water standpipes).

5. Buildings are usually upgraded to more permanent housing. The designs and patterns followed usually are similar to those established in the late Colonial Period. Almost all permanent buildings that evolve in these squatter settlements are of block and steel.

6. There is a much lower level of interaction among neighbors than in the yards; yet there is a high degree of community participation.

7. There is a high degree of political activism, and many squatter settlements have aligned themselves as a unit with one political party or another.

Squatter settlements are highly vulnerable to both hurricanes and earthquakes. The quality of construction is fairly poor, and even block and steel buildings are susceptible to damage. In a 1972 study of squatter settlements, it was found that 58% of the people that had reasonably secure tenure were interested in borrowing to upgrade their homes.[14] However, squatters do not have access to credit because of lack of legal tenure, so they are obliged to concentrate on very low-cost improvement measures rather than actions which could be taken to significantly reduce vulnerability. If major vulnerability reduction efforts are to be successful, some form of credit for home improvements will be required for squatters.

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[14] A Preliminary Outline of the National Program of Urban Upgrading, Orlando Patterson, Ministry of Housing, Jamaica, 1972.

CONTEMPORARY SEMI-ENGINEERED HOUSING

The government, as well as a number of low-cost housing corporations, has chosen the approach of using conventional housing projects or schemes as the method of providing housing for low-income families. The buildings erected in these schemes have utilized a variety of industrialized building systems, especially prefabricated and panel construction methods. The primary objective of these schemes is to deliver basic, durable housing to low-income families at the lowest possible price.

The building types normally erected in schemes do not fall under the purview of this study; however, any study of vulnerability of housing in Jamaica would be remiss in not addressing several key points regarding scheme housing. First, many of the projects have been built on land that is vulnerable to earthquakes and hurricanes. The sites chosen are often marginal lands that are easy to acquire at a low cost. With this in mind, the housing erected on these sites must be given special protection and attention. Little of either is evident. Many sites vulnerable to flooding have only marginal protection in the way of river embankments or sea walls; or houses are built on sites that are simply impossible to protect from storm surges or floods. Because the government has created these settlements and directed their development, it bears a special responsibility to prepare adequate protection and, in those settlements where protection is impossible, to develop adequate evacuation plans and construct secure evacuation routes. The most notable case in point is Portmore.

In regard to the houses, there appears to be an assumption that the use of concrete and steel in any form produces a building secure against disasters. In the course of this study, many of the building systems used appeared to be vulnerable to both hurricanes and earthquakes. Experience from other countries has demonstrated the weaknesses inherent in many of the construction systems now utilized in Jamaica. Of special concern are post-and-panel construction (in both hurricanes and earthquakes) and tilt-up or concrete panel construction (in earthquakes). It is important that the government undertake a thorough review of the vulnerability of these buildings and take steps to remedy the problem before a disaster occurs.